SENSITIVE SECURITY INFORMATION

SAFETY AND SECURITY RISK ASSESSMENT FOR THE PROPOSED SKIPANON LNG RECEIVING TERMINAL

OCTOBER 31, 2007

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Safety & Security Risk Assessment
Workshop
for
The Proposed Skipanon, OR
LNG Receiving Terminal
October 31, 2007

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Introduction

- Halcrow/HPA contracted by Oregon LNG to develop a Waterways Suitability Assessment (WSA) for proposed new LNG Terminal at Skipanon, OR
- The goals for this workshop are to;
  - Conduct the Risk Assessment of the WSA, and
  - Develop potential Risk Management Strategies
- The COTP, with the assistance of AMSC, will review and validate the WSA

Why Import LNG

- LNG production in the U.S. has reached its peak
- Plans to acquire LNG from Alaska, Canada, & Mexico via pipelines
- Overseas LNG will be increasingly more important requiring construction of new LNG import terminals
- Approximately 40 LNG terminals are being discussed for North America
- Six terminals are already operating in the U.S.

Approval Process for LNG Facilities

- FERC is the lead federal agency for shore based LNG facilities
- Coast Guard acts as a cooperating agency to FERC
  - Waterway Suitability Assessment process

Waterway Suitability Assessment (WSA)

- Required by Coast Guard (NVIC 05-05)
- The applicant (Oregon LNG) is required to develop WSA
- Intended to provide the COTP with information needed to assess the proposed LNG marine operations
- The WSA focuses on Prevention of Accidental and intentional releases of LNG cargo. The Emergency Response Plan will address Response to a release.

Waterway Suitability Assessment Outline

- Port Characterization
- Characterization of the LNG Facility and the LNG Tanker Route
- Risk Assessments (Safety & Security)
- Risk Management Strategies
- Resource Needs for Safety, Security and Response
- Conclusions and Recommendations

Goals of this Working Group

- Conduct safety and security Risk Assessment
- Identify prevention Risk Management Strategies to mitigate the identified risks
- Identify resource needs
- Identify Impacts on other Waterway Users

WSA Risk Assessment Process

- NVIC 05-05 requires applicant to use:
  - Risk-Based Decision Making (RBDM)
  - Sandia National Laboratory Report "Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill over Water"

Risk Based Decision Making (RBDM)

- Coast Guard RBDM Manual outlines different RBDM methodologies
- Each methodology has its own strengths and weaknesses
- We will be using the "Change Analysis"and "What If" methodologies

"Change Analysis"

- Identify potential changes to the existing waterway system which will occur with the addition of LNG ships enroute Sparrows Point
- Identify Possible Effects of said changes
- Identify existing Prevention Measures
- Recommendations for additional mitigation strategies where necessary

"What If" Analysis

- Address possible Safety & Security Scenarios along the track line through series of "What If" questions
- Determine consequences based on Zones of Concern
- Identify Existing Prevention Measures
- Recommendations for additional mitigation strategies where necessary

Sandia Lab Study

- Addresses threats to LNG ships & consequences of large spill
  - Examined previous studies
  - Mathematical modeling to identify threats which could possibly penetrate hull and release cargo
  - Modeled potential size of spills based on scenarios
  - Developed "Zones of Concern"

LNG Release Scenarios

- **Accidental**
  - Groundings
  - High & Low Speed Collisions
- **Intentional**
  - Sabotage
  - Projectile
  - Aerial
  - Surface
  - Underwater threats

Zones of Concern (Handout)

- Sandia report identifies three concentric Zones of Concern around a LNG tanker.
  - Zone 1: 500 meters
  - Zone 2: 1600 meters
  - Zone 3: 3500 meters

Zones of Concern #1

- This is the area with the most severe consequences around the LNG tanker,
- Extends 500 meters from the tanker
- Strategies should address vapor cloud dispersion and fire hazards
- Deterrent measures may include: security zones, waterway traffic management, positive control of shipping.

Zones of Concern #2

- Less severe consequences than Zone 1
- 500 meters to 1600 meters (approx 1 mile)
- Strategies should address vapor cloud & fire hazards
- Deterrent measures – When major critical infrastructure elements occur in Zone 2 measures should include incident management, areas of refuge (enclosed areas, buildings), community warning & education.

Zones of Concern #3

- Least likelihood of severe consequences
- 1600 meters to conservative 3,500 meters (2.2 miles)
- Risk Management strategies should address vapor cloud dispersion
- Deterrent measures – When major critical infrastructure elements occur in Zone 3 measures should include incident management, areas of refuge (enclosed areas, buildings), community warning & education.

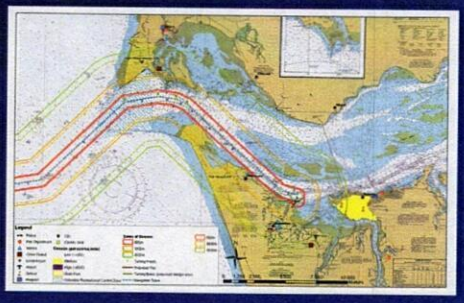
Expanded Zones of Concern

- The Sandia Zones of Concern are based on a vessel of 148,000 cubic meters
- The new Q-Max class of LNG vessel is 265,000 cubic meters
- Sandia is developing revised Zones of Concern for the larger vessels
- Discussions with Sandia Lab and Coast Guard HQ expect new Zones to be less than 10% greater than existing Zones

Expanded Zones of Concern (Cont.)

- Halcrow/HPA has included "expanded" Zones of Concern 12% larger than current Zones
- Intent is to avoid a second Risk Assessment Workshop when Sandia Report is released
- Expanded Zones
  - Zone 1: 560 meters
  - Zone 2: 1800 meters
  - Zone 3: 4000 meters

Example Zones of Concern & "Expanded" Zones of Concern



USCG Role In The Proposed Skipanon, OR Liquefied Natural Gas Terminal Expansion

USCG Mission Responsibilities for New LNG Terminals

- The Coast Guard is required to assess the suitability of the waterway for LNG marine traffic associated with an LNG terminal or expansion, and issue a Letter of Recommendation (LOR).
- NVIC 05-05 details how to assess the suitability of the waterway for LNG marine traffic through completing a waterway suitability assessment (WSA).

USCG WSA/LOR Process

- The applicant (Oregon LNG) prepares the WSA.
- The USCG reviews and validates the WSA in collaboration with local stakeholders.
- USCG submits a Waterway Suitability Report to FERC, for inclusion in their Environmental Impact Statement (EIS) and also for consideration by the FERC Commissioners when they make their permitting decision for the proposed LNG terminal.
- The USCG reviews the EIS to ensure it meets the USCG needs for issuance of an LOR.

CHANGE ANALYSIS TABLE

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
		Increased chance of collision and/or grounding. Increased chance of dock allisions due to more mooring evolutions.	Safety/security boarding conducted on CDC ships prior to entry into Columbia River. ANOA required by CG and ANE required by WA State Dept of Ecology.	
1	Additional ships transiting Lower Columbia River	Commercial ship traffic delays in river due to increased number of vessels transiting. Potential delay of cruise ships. Additional disruption of commercial and recreational fishing. Increased activity for Bar Pilots. (Additional helicopter and pilot boat activity.) Increased requirement of CG offshore boardings (security and certificate of compliance) Increased requirement for CG port state control boardings.	Pilots required aboard all LNG ships for transit and docking. River/Bar Pilots maintain awareness of ship traffic and manage ship transit activity Pilots actively monitor water level to ensure sufficient water under keel prior to bringing ships over bar and in river. Bar closure provisions and/or suspension of service provisions in place for hazardous conditions. Sufficient aids to navigation to facilitate safe navigation Port State Control boardings conducted to monitor/enforce safety/security standards (including STCW)	Active management of vsl traffic by Columbia River Pilots to minimize delays and avoid meeting situations of the larger commercial vessel in the Desdemona Shoals Channel. Manage LNG vessel arrivals to avoid disruption of Buoy 10 fishing season (ie consider only permitting entry in late afternoon/evening when fishing activity typically lessens or after dark)

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
2	Larger ships/New class of ships	Increased chance of grounding/collision due to increased size of ships and new handling characteristics of ships. Increased chance of dock allisions as pilots familiarize themselves with new ship characteristics and mooring techniques. Dredging required for turning basin and approach to dock.	Sufficient ATON to facilitate navigation (or are there needed improvements?) CR ship channel now maintained to control depth of 43' in transit area by COE Ships highly regulated and required to have double bottoms, specific fire fighting equipment, electronic sensor & control systems (radar, AIS, radios, etc), safety equipment, redundant propulsion, steering, and auxiliary equipment. Ships are required to certify that their equipment is operating properly prior to entry into Columbia River. Pilots ensure state of tide provides adequate water under keel prior to bringing ships into river system	Simulator training for CR Bar pilots on new ship characteristics entering,/transiting river and docking procedures. Escort inbound ships with tugs where appropriate. Identify/Ensure an adequate number/capability of tugs available to escort and maneuver ships to dock Gauge needed to more accurately measure water depth and current in area of CR Bar???? (Note in WSR for Bradwood) Monitor depth of water and conduct maintenance dredging as required at terminal and turning basin.
3	Introduction of LNG cargo by ship	Risk of cargo tank breach with release of cargo from accidental or intentional action. Will require establishment/	LNG ship crewmembers required to have specific training for their ships. Sector Portland Port Guidelines for COTP Zone addresses:	Establish security zones around LNG ships when carrying cargo above their heel Require armed security boat escorts of loaded ships entering

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
		implementation of safety/security zone around ships which in turn may cause: • Disruption to recreational & fishing vessels operating near channels. • One-way commercial ship traffic in Desdemona Shoal Channel. • Requirement for escort boats to enforce zone.	• Requirements for tank vessels to conduct propulsion test prior to entry into US waters. • Basic boarding policies. • Anchoring offshore. Sector Portland has stated that LNG ships and cruise ships will not meet in ship channel in WSR for Bradwood.	port to enforce security zone. Require sufficient tug support to escort ship from Sand Island Range Channel to terminal. Manage vessel traffic to avoid or minimize meeting situations of large commercial ships in Desdemona Shoal Channel. Manage LNG vessel arrivals to avoid disruption of Buoy 10 fishing season (i.e. consider only permitting entry in late afternoon/evening when fishing activity typically lessens or after dark) The Port Guidelines need to be expanded to address specific LNG Ops requirements or there needs to be a specific LNG Operations Plan/Vessel Transit Plan developed for the Columbia River to outline vessel traffic management requirements, weather restrictions for transit and cargo transfer, boarding procedures, escort procedures, tug use and standby requirements, limitations on bunkering or provisioning, emergency warning

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
				procedures, etc.
4	New LNG Facility in port	Deep draft vessel activity in area where there was not before – potential for allisions and grounding while approaching/departing dock. New tug and security vessel activity in area. Establishment of fixed security zone may restrict vessel movement entering or leaving Skipanon Waterway, depending on size of zone. Possible delay of inbound/outbound ships while LNG vsl maneuvered out of ship channel and turned around for mooring. May require transit speed to be lowered by commercial ships passing the terminal to avoid creating wake/surge/suction for ships offloading at dock. Potential allision with LNG ship moored at facility or with dock by other ships transiting inbound approaching Tansy Pt turn if they experience steering or propulsion	Security plan requirements from MTSA/ISPS will apply for terminal.	Determine need for new or additional ATON to ensure channel turn is better marked to decrease chance of nave error particularly in decreased visibility Establish a fixed security zone around facility when ships moored (and when no ship moored??) Require waterside security patrol while ship is moored if no boom. Require tug on immediate standby while ship moored/offloading. Construct dock with some form of protection for moored ships from threat of allision from another ship experiencing steering or power failure. Develop no passing policy in vicinity of Tansy Point Turn. Consider establishing speed restrictions of large ships passing facility in shipping channel.

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
		casualties or if pilots misjudge turn and "swing wide" at Tansy Pt turn.		
5	Cargo transfer activity at facility	Risk of break in connection due to system failure. Risk of break in connection due to human error. Weather/Wind may cause vsl to shift and break connection. Risk of break in connection due to surge of passing ships.	Existing equipment safety standards provide automatic cut off valves if there is a break. Existing standards for transfer personnel to actively monitor all transfer operations so that they can shut transfer valves if the automatic system fails. Requirement exists within CG regs for inspection and monitoring of cargo transfer ops.	Develop emergency procedure plan. Ensure emergency disconnect gear installed and working properly. Install gas detection meters IAW regulations. Recommend policy for standby tugs, movement of ship in event of rising weather conditions, or additional mooring gear. Recommend tension gauges on mooring lines to indicate potential breaking point. Enforce training, qualifications & standards for facility personnel. Consider establishing speed restrictions of large ships passing facility in shipping channel.
6	Increased tug activity	Anticipate requirement for 3-4 tugs for LNG ship operations at terminal. Additional risk of collision.	Standard rules of the road apply to ensure safe operations.	Ensure tug crews adequately trained for handling new class of ships and familiar with area. Ensure tug captains appreciate need to operate courteously in

Difference from Normal Port Activities		Possible Effects	Risk Control Strategies	
			Existing Prevention Policies/Practices/Requirements	Recommended Additional Requirements
		Impact on recreational boaters using area adjacent to facility and along Desdemona Channel as tugs proceed to escorts.		vicinity of small boats.

Cape Disappointment Beach/North Jetty of Columbia River Mouth
Line depicts outer edge of Zone 2 for an incoming LNG Tanker on the Track Line.

Cape Disappointment State Park with Zone 2 and Zone 3 Outer Limits
Ilwaco
Ruby Island
Sand Island
Page 2
Image © 2007 DigitalGlobe
© 2007 Europa Technologies
Image © 2007 TerraMetrics
Image State of Oregon
Streaming 100%
6288 ft
Pointer 46°17'04.87" N 124°03'42.39" W elev 29 ft
Eye alt 21738 ft
©2007 Google™

Zone 1 over Hammond Marina
Page 3
Image © 2007 DigitalGlobe
© 2007 Europa Technologies
Image State of Oregon
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Pointer 46°11'42.02" N 123°56'09.76" W elev 6 ft
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Hammond Marina to Tansy Point
Zone 1 Limit
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Image State of Oregon
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Hammond Point and Hammond Marina
with Zone 1 Line of Demarcation
Hammond
Image State of Oregon
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
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Hammond Shoreline with condos and
Zone 1 Line
Hammond
1282 ft
Pointer 46°11'56.56" N 123°56'28.41" W elev 0 ft
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Tansy Point with Zone 1 Line
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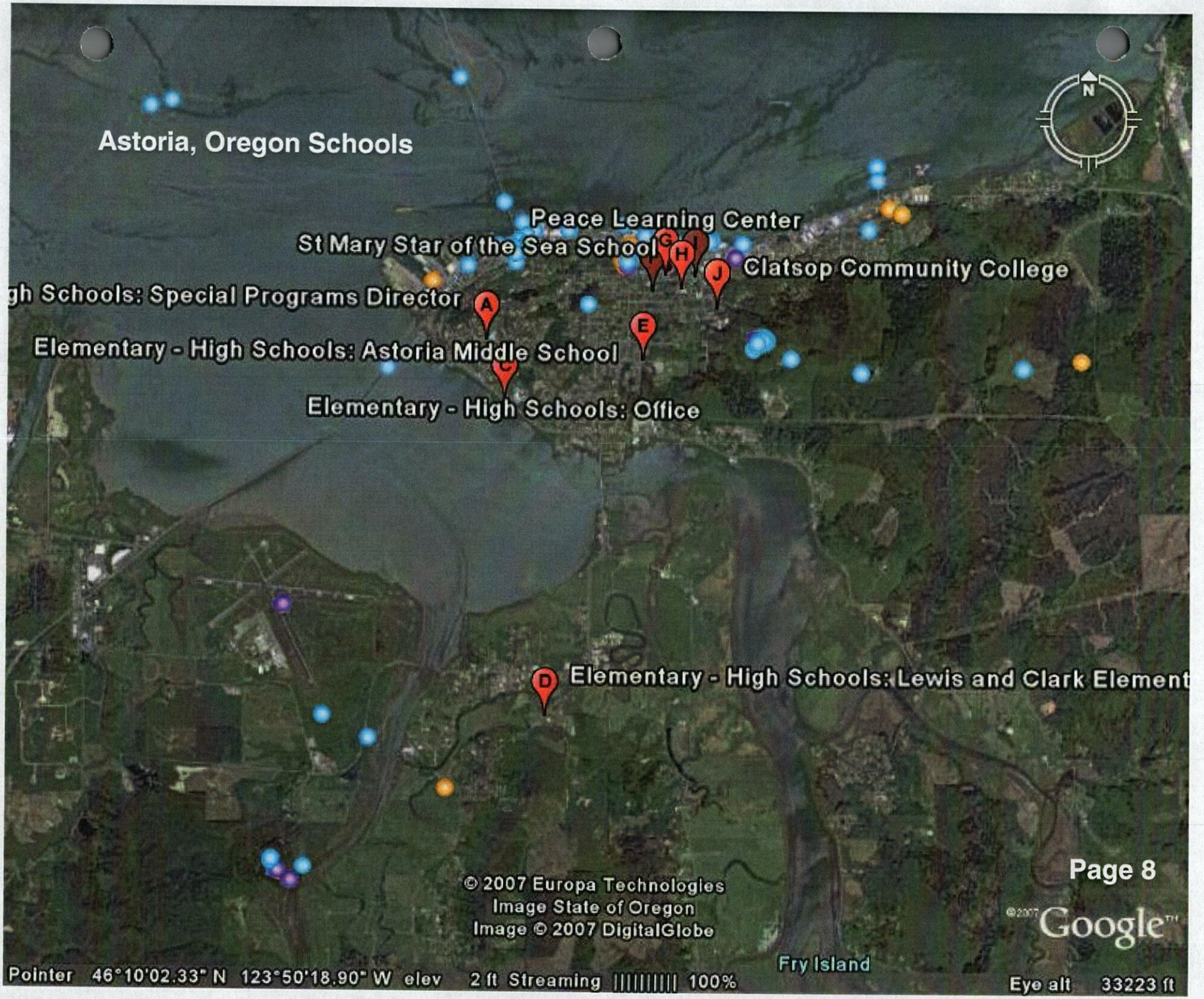
Astoria, Oregon Schools
Peace Learning Center
St Mary Star of the Sea School
Clatsop Community College
gh Schools: Special Programs Director
A
E
Elementary - High Schools: Astoria Middle School
C
Elementary - High Schools: Office
D
Elementary - High Schools: Lewis and Clark Element
Page 8
© 2007 Europa Technologies
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Image © 2007 DigitalGlobe
©2007 Google
Fry Island
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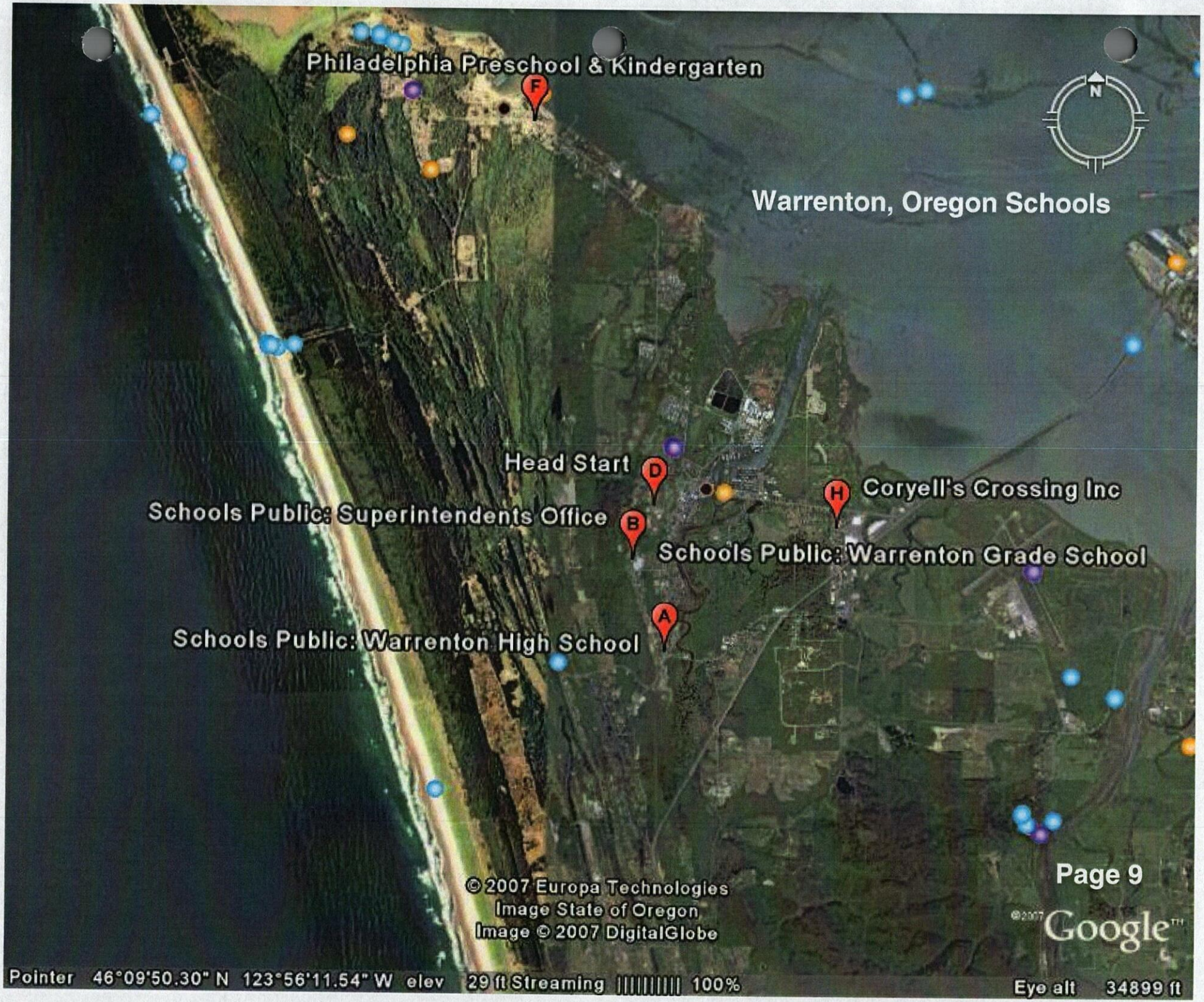
Philadelphia Preschool & Kindergarten
F
N
Warrenton, Oregon Schools
Head Start
D
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Coryell's Crossing Inc
Schools Public: Superintendents Office
B
Schools Public: Warrenton Grade School
A
Schools Public: Warrenton High School
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Image State of Oregon
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Page 9
©2007 Google™
Pointer 46°09'50.30" N 123°56'11.54" W elev 29 ft Streaming 100%
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Estimated average monthly boat count by fishery in the Columbia River downstream of the Astoria-Megler bridge.

		Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Total
Columbia River	Sport Sturgeon[acd]					1,545	4,160	1,540	181	16				7,442
	Sport Salmon (Buoy 10)[ace]								14,980	6,914				21,894
	Sport Bottomfish[af]		60	150	90					60				360
	Sport Crabbing[ai]	500	30	15	10	50	150	200	450	450	850	650	700	4,055
	Commercial Gillnet[ag]	2	4	10		49	15	44	279	60	109			572
	Commercial Crabbing[ah]	185	90										400	675
Transit via Columbia River	Ocean Sport Salmon[bc]					8	40	744	2,638	569				3,999
	Ocean Sport Halibut/Bottomfish[bc]					53	35	26	10	4				128
	Ocean Sport Tuna[bc]					0	4	9	15	12				40
	Ocean Crab [k]													0
	Ocean Comm. Crab[bl]	862	769	447	364	242	127	61	32				464	3,368
	Ocean Comm. Shrimp[bl]				43	86	71	64	64	66	45			439
	Ocean Comm. Bottomfish[bl]*	54	82	66	102	146	192	180	175	136	110	54	55	1,352
	Ocean Comm. Salmon[bl]			6	4	105	41	26	42	25	7			256
	Ocean Comm. Sardine[bl]						68	436	604	414	110	6	2	1,640
	Ocean Comm. Tuna[bl]						4	78	124	84	37			327
	Ocean Comm. Whiting[bl]						128	216	50	2				
Total		1,603	1,035	694	613	2,284	5,035	3,624	19,644	8,812	1,268	710	1,621	46,547

Peak periods

[a] Combined OR/WA data

[b] Oregon only data. All combination trips are assigned to salmon effort (salmon+bottomfish, salmon+tuna, and salmon+halibut), May through Sept effort only

[c] 2002-06 effort based on exit counts of boats that are then assigned to trip type based on interviews on a portion of the boats at the end of their trips.

[d] Season open Jan 1-Apr 30 and mid-May thru harvet quota (around Jul 4).

[e] Season open Aug 1 thru Dec 31. Main part of season is mid-Aug thru early-Sep.

[f] Educated guess

[g] 2006 data

[h] Based on commercial crabber estimate

[i] 2004-06 creel data

[j] 2002-2006 average of Troll Salmon Deliveries (should roughly equate to vessel bar crossings)

[k] Ocean recreational crabbing is usually part of another targeted fishing trip, and would be included with other listed trip types.

[l] 2002-2006 average of fish ticket deliveries

Red text indicates effort doubled to represent both seaward and return trip

Skipanon OR LNG Receiving Terminal
Waterway Suitability Assessment October 2007
Vulnerability Criteria (NVIC 9-02 Change 2)

Vulnerability Categories (Table 5, NVIC 9-02)

AVAILABILITY	The target's presence and predictability as it relates to the ability to plan an attack.
ACCESSIBILITY	Accessibility of the target to the attack scenario. This relates to physical and geographic barriers and distances to the target that deter the threat without organic security.
ORGANIC SECURITY	The ability of security personnel to deter the attack. It includes possible evasive actions by the vessel, security plans, communication capabilities, guard force, intrusion detection systems, and timeliness of outside law enforcement to prevent the attack.
TARGET HARDNESS	The ability of the target to withstand the specific attack based on the complexity of target design and material construction characteristics.

Vulnerability Score (Modeled on Table 6, NVIC 9-02)

Category	Availability	Accessibility (External Threats)	Organic Security (Internal Threats)	Target Hardness
High (4)	Always available (continual presence or present daily on a set schedule)	No deterrence: Unrestricted access to the vessel: - Ship operating in protected waters - Ship limited in ability to maneuver - Slow speed , 10 kts or less - High boating concentrations - No escort vessels to deter or disrupt approach	No deterrence: No security plan: - unrestricted internal movement - no guard force - no emergency communication, outside L.E. not available for timely prevention - No detection capability	Intent of attack easily accomplished (e.g., readily damaged or destroyed)
Medium (3)	Often available (e.g. present several times a month; arrival & departure times predictable 1 week to 2 months in advance; predictable)	Some deterrence - No access closer than 100 yard, and - Controlled access from 500 yard to 100 yard if in restricted/protected waters	Some deterrence Valid security Plan including: - Access controls to keep unauthorized persons and unauthorized materials off the vessel - Communications/Ship Security Alert System - Restricted areas/spaces identified and locked. - Communications/Ship Security Alert System	Good ability to withstand attack (e.g. simple design but relatively strong construction)

Category	Availability	Accessibility (External Threats)	Organic Security (Internal Threats)	Target Hardness
Low (2)	Rarely available (e.g. no set schedule and on any given day presence highly unlikely and unpredictable; arrives once a year or less for a few hours and arrival is not publicly known)	<u>Good deterrence</u> - No access closer than 500 yards, or - Difficult to approach due to : o Open ocean water o Ship traveling at high speed o Ship able to maneuver o Mandatory tugboat escort	<u>Good deterrence</u> - Valid security plan and - Periodic security guard force (POSCON)	Target expected to withstand attack (complex design and substantial construction of target minimizes success of attack)
Very Low (1)		<u>Best deterrence</u> - No access within 1,000 yards, and - Security Zone enforced with sufficient escort boats equipped to respond/ defeat threat - Escort tug teathered	<u>Best deterrence</u> - Valid security plan/program, and - Continuous security guard force (POSCON), and - consider augmented POSCON Team	

Consequence Table

Population Density	Low (Zone 3)	Medium (Zone 2)	High (Zone 1)
High	3	3	3
Medium	2	2	3
Low	1	2	3

Zone of Concern

FROM :BAR PILOT FAX NO. :503 325 5630 Aug. 09 2007 12:12PM P4

COLUMBIA RIVER BAR MONTHLY TRAFFIC

1992 – 2007

MONTH	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	AVERAGE 2002-2007
Jan	301	339	335	303	347	336	331	345	323	342	286	249	280	268	256	271	268.3
Feb	363	347	329	380	305	318	309	302	328	319	268	237	297	245	270	292	268.2
Mar	359	343	341	366	346	359	316	328	337	303	272	281	301	276	277	303	285.0
Apr	353	368	365	355	308	315	309	320	377	334	260	290	267	244	254		263.0
May	338	367	355	342	342	323	339	368	366	326	261	298	306	272	290		285.4
June	349	294	358	341	302	331	341	339	342	293	293	285	315	258	321		294.4
July	341	323	337	363	285	333	289	361	349	300	267	286	258	263	289		272.6
Aug	355	345	348	386	362	325	319	380	344	316	301	315	287	282	309		298.8
Sept	366	345	361	364	337	362	340	343	326	308	289	313	306	286	323		303.4
Oct	386	368	355	406	353	351	375	360	377	325	292	307	315	287	290		298.2
Nov	360	319	393	384	332	353	321	342	324	317	283	327	275	277	271		286.6
Dec	341	350	363	343	298	295	318	333	306	301	277	284	247	263	299		274.0
TOTAL	4212	4108	4240	4333	3917	4001	3907	4121	4099	3784	3349	3472	3454	3221	3449	866	3397.9
AVERAGE	351.0	342.3	353.3	361.1	326.4	333.4	325.6	343.4	341.6	315.3	279.1	289.3	287.8	268.4	287.4	288.7	283.2
Year to Year		-2.5%	3.2%	2.2%	-9.6%	2.1%	-2.3%	5.5%	-0.5%	-7.7%	-11.5%	3.7%	-0.5%	-6.7%	7.1%	7.8%	

Logbook ship numbers

NOTE:

Summary of "Zones of Concern" for Intentional LNG Spills

The Sandia Labs Report identifies three concentric Zones of Concern around a LNG tanker, which are summarized below for the case of an intentional LNG spill, and are particularly useful for conducting a risk assessment of a waterway for LNG marine traffic.

Zone 1: This is the area with the most severe consequences around the LNG tanker, where an LNG spill could pose a severe public safety and property hazard and could damage or significantly disrupt critical infrastructure and key assets located within this area. Zone 1 is considered to extend about 500 m (0.3 miles) for an intentional breach of an LNG tanker. Risk management strategies should address vapor cloud dispersion and fire hazards. The most rigorous deterrent measures should be considered when major critical infrastructure elements, such as population or commercial centers, lie within Zone 1. These measures should include such things as vessel security zones, waterway traffic management, and establishment of positive control over vessels. Coordination among all port security stakeholders is essential. Incident management and emergency response measures should be carefully evaluated to ensure adequate resources (i.e., firefighting, salvage) are available for consequence and risk mitigation.

Zone 2: This is an area with less severe consequences than Zone 1 and is considered to extend from 500 m (0.3 miles) to 1,600 m (1 mile) for an intentional breach of an LNG tanker. Risk management strategies should address vapor cloud dispersion and fire hazards. When major critical infrastructure elements occur within Zone 2, risk management strategies that should be considered include incident management and emergency response measures that ensure areas of refuge (enclosed areas, buildings) are available, the development of community warning procedures, and education programs to ensure that communities are aware of precautionary measures.

Zone 3: This is an area with the least likelihood of severe consequences and is considered to extend from 1,600 m (1 mile) to a conservative maximum of 3,500 m (2.2 miles) from the LNG tanker, in the unlikely event that 3 cargo tanks were breached and a vapor cloud disperses without an initial ignition. Risk management strategies should address the vapor cloud dispersion hazard. When major critical infrastructure elements occur within Zone 3, risk management strategies that should be considered include incident management and emergency response measures that ensure areas of refuge are available and community education programs should be considered to ensure that people know what to do in the unlikely event of the release of a vapor cloud without initial ignition.

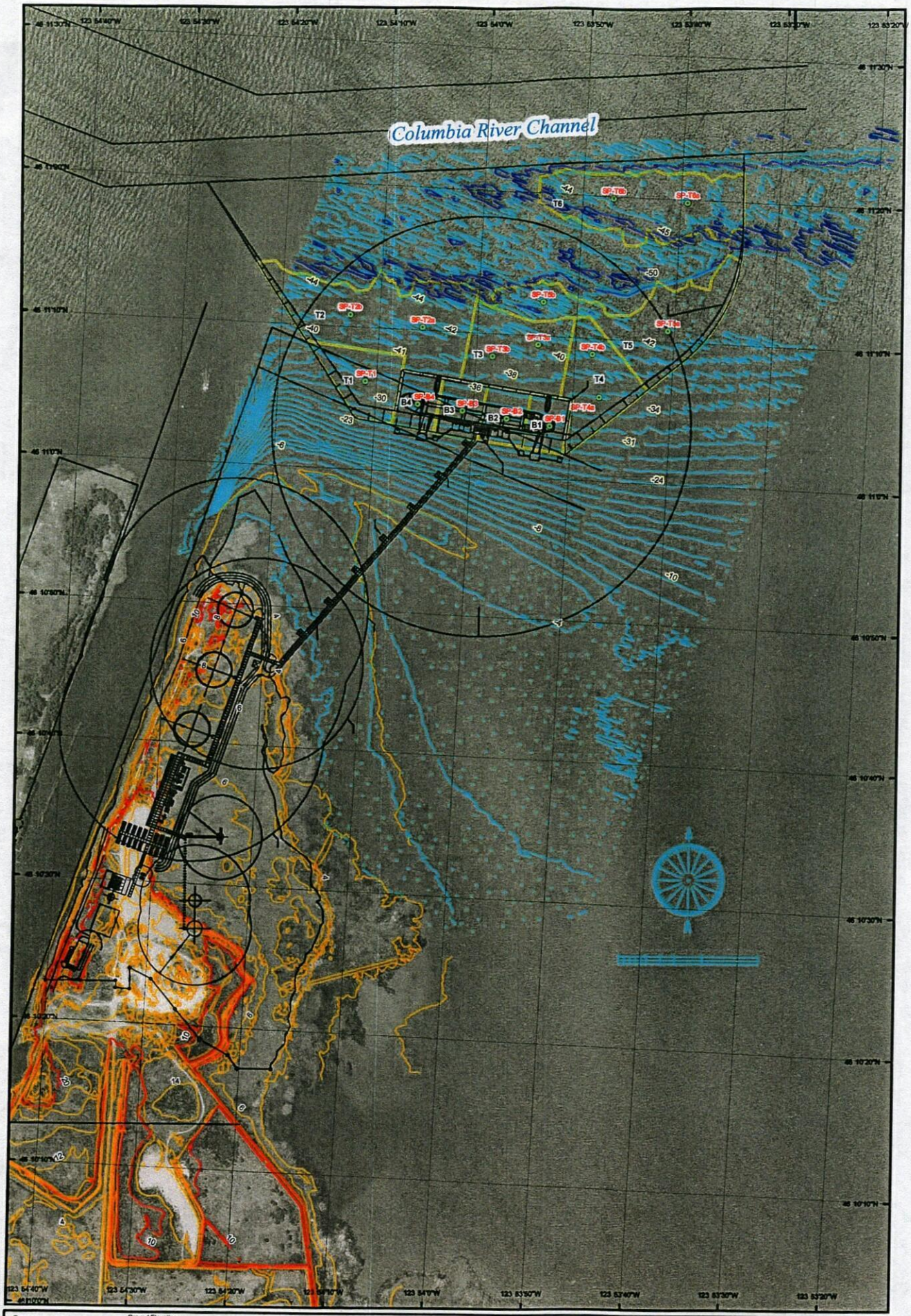

Figure 2

Oregon LNG Facility

Warrenton, Oregon

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Casualty Data for the Columbia River involving Columbia River Bar Pilots[1]

1. A review of the safety record of overall LNG shipping history worldwide reveals no serious cargo breaches within the entire 40-plus years of operation. In the past 40 years there have been more than 33,000 LNG ship voyages without a significant accident or cargo security.[2] Such a historical review; however, does not reflect the likelihood of a future accident occurring in the Lower Columbia River. Accordingly the most appropriate historical records were deemed to be the safety records of the Columbia River Bar Pilots as they would be the professional navigating the ships across the bar and up to the proposed terminal site.

2. Table #1 provides a summary of the Columbia River Bar Pilots Reportable Marine Casualty data over the last 10 years.

Table #1: Columbia River Bar Pilots Casualties (1997-2007):

Type of Casualty	Number
1. Groundings	2
2. Collisions at Low Speed	0
3. Collisions at Low Speed involving vessels of over 50,000 GT	0
3. Collisions at High Speed (> 7 kts)	4
4. Collisions at High Speed involving vessels of over 50,000 GT	0
4. Allisions with Bridges	0
5. Allisions with docks/piers	0

3. Casualty Details

a. Groundings - Both of the groundings occurred in the vicinity of Buoy 14. One of the groundings occurred when the pilot was maneuvering to avoid as small boat. The second grounding occurred due to a system failure on the vessel (steering or propulsion). Neither of the groundings resulted in significant hull damage to the vessel

b. High speed (>7 kts) collisions involving Columbia River Bar Pilots:
   (1) Two of the high speed collisions involved tugs with barges;
   (2) One of the high speed collisions involved a dredge in the vicinity of buoy #8; and
   (3) The fourth collision was with the CG Cutter Cowslip in the vicinity of the Tansey Point turn.

c. High speed collisions between vessels of over 50,000 GT – None.

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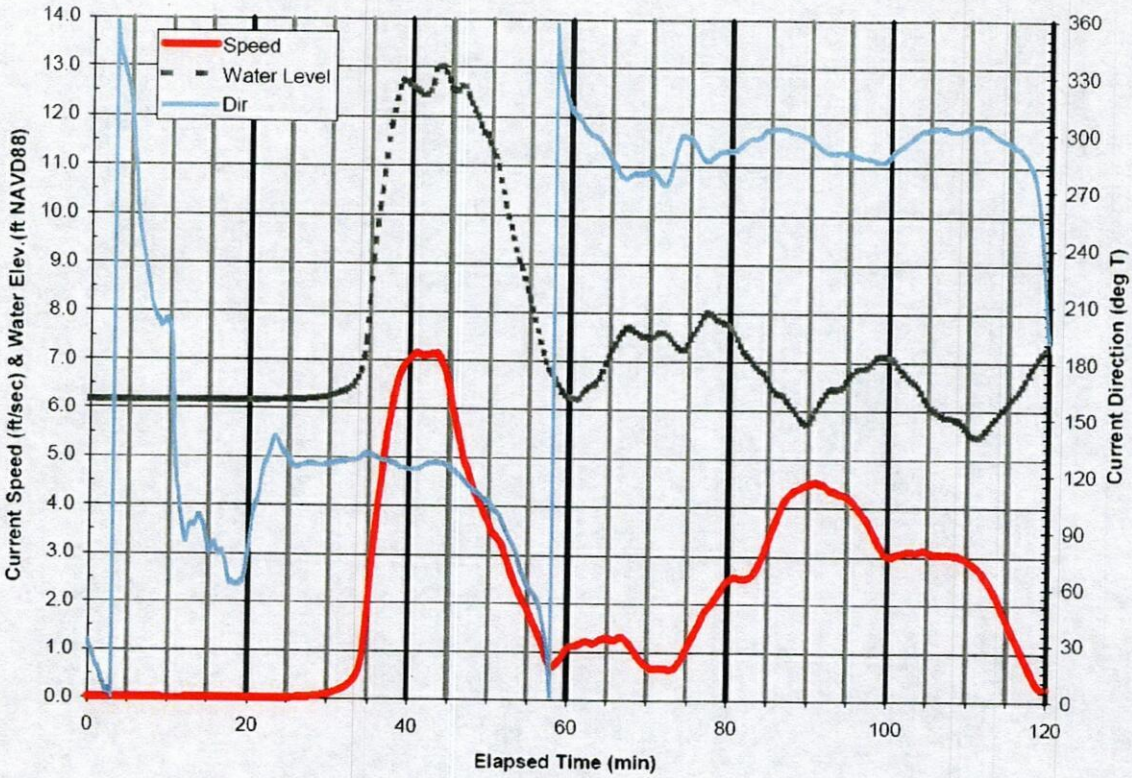
[1] Safety Data provided by the Columbia River Bar Pilots, Captain Gary Lewin
[2] Federal Energy Regulatory Commission (FERC) Website

4. Capt Lewin stated that there have been no collisions involving two vessels piloted by Columbia River Bar Pilots. This is significant in that the Sandia Study found that unless a vessel or object had an unusually sharp point, collisions that could penetrate the double hull of an LNG tanker involved vessels of over 50,000 GT. Pilotage across the Columbia River bar is compulsory for U.S. vessels and all foreign vessels (except foreign recreational or fishing vessels not more than 100 feet in length or 250 gross tons international)[3]. Therefore, any vessel large enough to meet the Sandia collisions scenario (50,000 GT) must have a pilot on board when crossing the Columbia River bar.

5. Table #2 provides the risk assessment scoring guidelines used in this Assessment.

Table #2: Risk Assessment Scoring Guidelines

Incidents	Risk	Score
0 - 1	Low	1
2 – 3	Medium	2
4+	High	3

[3] United States Coast Pilot 7, Page 441

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